

REMARKS/ARGUMENTS

Favorable reconsideration of this application as presently amended, and in light of the following discussion, is respectfully requested.

Claims 1-51 are pending; Claims 1, 3, 6, 9, 13, 17, 21-26, 29-33, 38, and 39 are amended; Claims 47-51 are newly added. No claims are cancelled. Support for newly added Claims 47-51 and for the amendments to Claims 1, 38, and 39 can be found in original Claim 1 and in numbered paragraphs [0023], [0024], [0025], and [0030] of the specification, for example, which disclose the deposition of SiGe films, epitaxial and polycrystalline Si films and multiple forms of substrates. Support for the amendment to Claim 13 can be found at page 11, numbered paragraph [0039], for example. Claims 3, 6, 9, 17, 21-26, 29-33, and 38 are amended to address minor informalities and to conform to the antecedent basis provided in amended Claim 1. No new matter is added.

In the outstanding Office Action, Claims 1, 2, 4, 5, 7, 8, 10-24, 27-30, and 34-46 were rejected under 35 U.S.C. §102(e) as anticipated by Seutter et al. (U.S. Patent Pub. 2003/0215570, hereafter "Seutter"); and Claims 3, 6, 9, 25, 26 and 31-33 were rejected under 35 U.S.C. §103(a) as obvious over Seutter.

At the outset, Applicants note with appreciation the courtesy of an August 3, 2005 personal interview extended by Examiner Monica Harrison and Primary Examiner Laura Scillinger to Applicants' representatives.

Regarding the rejection of Claims 1, 2, 4, 5, 7, 8, 10-24, 27-30, and 34-46 as anticipated by Seutter, that rejection is respectfully traversed by the present response.

Amended Claim 1 recites, in part, "exposing a HCD process gas to the substrate; and depositing a silicon or silicon or silicon-germanium film on the substrate using the HCD process gas."

Seutter describes using a combination an HCD process gas as a silicon precursor supplied in a pulse to a substrate after which a nitrogen precursor is supplied in a separate pulse to the substrate in order to form a **silicon nitride** film. Applicants respectfully submit that a person of ordinary skill in the art would understand that the silicon nitride films described in Seutter are not silicon or silicon-germanium films. Nowhere in Seutter is a silicon or silicon-germanium film deposited via exposure to HCD disclosed. Instead, Seutter repeatedly describes the deposited layer as a silicon nitride layer. In fact, the entire Seutter disclosure is devoted to the deposition of a silicon nitride layer. For example, the title of Seutter states, "Deposition of Silicon Nitride." The preamble to Claim 1 of Seutter states, "[a] method of depositing a silicon nitride film over a substrate surface..." Accordingly, as one of ordinary skill in the art would understand a silicon nitride film to be different than a silicon or silicon-germanium film, Applicants respectfully submit that amended Claim 1 patentably distinguishes over Seutter for at least the reasons discussed above.

Regarding Claims 2-38, Applicants respectfully submit that as these claims depend, directly or indirectly, from amended Claim 1, Claims 2-38 patentably distinguish over Seutter for at least the same reasons as amended Claim 1.

Amended Claim 39 recites a substantially similar feature to the one discussed above regarding amended Claim 1. Accordingly, Applicants respectfully submit that amended Claim 39 patentably distinguishes over Seutter for at least the same reasons as amended Claim 1.

As Claims 40-46 depend, directly or indirectly, from amended Claim 39, Applicants respectfully submit that Claims 40-46 patentably define over Seutter for at least the same reasons as amended Claim 39.

Applicants also present the following remarks regarding dependent Claims 18, 20, and 26, which, as discussed during the personal interview, Applicants respectfully submit patentably define over Seutter for at least the following additional reasons:

Regarding dependent Claim 18, Claim 18 relates to exposing at least one of GeH<sub>4</sub> and GeCl<sub>4</sub> to the substrate. Applicants respectfully submit that Seutter does not disclose GeH<sub>4</sub> or GeCl<sub>4</sub>. The outstanding Office Action points to paragraph [0023] of Seutter for the features GeH<sub>4</sub> or GeCl<sub>4</sub>. Paragraph [0023] states:

Preferably, the silicon precursor used is hexachlorodisilane having a low content of impurities. It has been observed that hexachlorodisilane having a high content of aluminum, copper, and/or **germanium impurities** may adversely affect the quality of the deposited silicon nitride film. Preferably, hexachlorodisilane has a low content of aluminum impurities of about 3,700 ppb (parts per billion) or less, more preferably about 3.0 ppb or less, copper impurities of about 6,800 ppb or less, preferably about 10 ppb or less, **germanium impurities** of about 1,200 ppb or less, preferably about 17 ppb or less, and titanium impurities of about 10 ppb or less.<sup>1</sup> (Emphasis added).

Accordingly, paragraph [0023] merely describes germanium impurities. Nowhere in Seutter are the specific compounds GeH<sub>4</sub> or GeCl<sub>4</sub> disclosed. Accordingly, Applicants respectfully submit that Claim 18 patentably defines over Seutter for at least this additional reason.

Similarly, dependent Claim 20 recites exposing GeH<sub>4</sub> to the substrate. Accordingly, Claim 20 patentably distinguishes over Seutter for at least the additional reason discussed regarding dependent Claim 18.

Regarding dependent Claim 26, as discussed in the personal interview, Claim 26 recites, in part “depositing a SiGe film having a germanium content greater than about 2 atomic percent. As is clear from the quotation from Seutter included above, germanium impurities are of about 1,200 ppb or less, clearly less than about 2 atomic percent. As nowhere else in Seutter is a larger amount of germanium disclosed, Applicants respectfully

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<sup>1</sup> Seutter, pg. 2, paragraph 0023.

submit that Seutter fails to anticipate all of the features of Claim 26 for at least this additional reason.

Regarding newly added Claims 47-50, as these claims depend from amended Claim 1, Applicants respectfully submit that Claims 47-50 patentably distinguish over Seutter for at least the same reasons as amended Claim 1.

Applicants also wish to make the following additional remarks regarding Claims 21, 29, and 47-50. All of Claims 21, 29, and 47-50 recite the feature of an epitaxial silicon film or the feature of an epitaxial silicon-germanium film. In contrast, Seutter does not disclose any epitaxial films. The outstanding Office Action points to Seutter, numbered paragraph [0019], for the feature of depositing an epitaxial layer. However, the monolayer disclosure referenced in [0019] does not itself constitute an epitaxial teaching. Further, the teaching of numbered paragraph [0019] of Seutter is directed to more general cyclical layer deposition and does not teach that Seutter's silicon nitride is epitaxial.

Applicants further submit that one of ordinary skill in the art would understand that silicon nitride is not capable of forming epitaxial layers. A courtesy copy of a relevant webpage discussing the nature of silicon nitride is enclosed.<sup>2</sup> As discussed in the webpage, silicon nitride is incapable of forming epitaxial (single crystal) layers. Accordingly, Applicants respectfully submit that Claims 21, 29, and 47-50 patentably distinguish over Seutter for at least these additional reasons.

Regarding newly added Claim 51, this claim recites, in part, "depositing a silicon-containing non-insulating film on the substrate using the HCD process gas."

In contrast, Seutter does not disclose depositing a non-insulating film on a substrate. Rather, Seutter repeatedly describes the deposited silicon nitride layer as a **dielectric** (insulating) layer. For example, Seutter states:

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<sup>2</sup> See <http://www.cerbec.com/TechInfo/Materials2.asp>, last visited August 29, 2005.

A gate **dielectric layer 514** is formed over the substrate 512. The gate **dielectric layer 514** may comprise a silicon nitride layer, a stack including one or more **silicon nitride layer** (such as a SiN/SiO<sub>2</sub> stack or a SiN/SiO<sub>2</sub>/SiN stack), or **other dielectric materials**. In one embodiment, the **dielectric layer 514** is deposited to a thickness of less than about 30 Å, preferably between about 5 Å and about 30 Å. A gate electrode 516, such as a polysilicon layer or other conductive materials, is formed over the gate **dielectric layer 514**. A doping process is performed to form a lightly doped region 520. Sidewall spacers 524 comprising silicon nitride or other **dielectric materials** are formed flanking the gate 514, 516. In one embodiment, the sidewall spacers 524 are formed by depositing silicon nitride to a thickness between about 200 Å and about 400 Å. A doping process is performed to more heavily dope source/drain regions 526. A reactive metal, such as cobalt or titanium, is deposited over the source/drain regions 526 and over the gate 514, 516 to form metal silicide contacts 530. A passivation layer 532 and metal contacts 534 are formed 534 over the metal silicide contacts.<sup>3</sup> (emphasis added).

Nowhere in Seutter is the silicon nitride layer disclosed as being non-insulating.

Accordingly, Applicants respectfully submit that newly added Claim 51 patentably distinguishes over Seutter for at least the reasons discussed above.

Consequently, in light of the above discussion and in view of the present amendments, the present application is believed to be in condition for allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,  
MAIER & NEUSTADT, P.C.



Steven P. Weihrouch  
Registration No. 32,829

Edwin D. Garlepp  
Registration No. 45,330

Customer Number  
**22850**

Tel: (703) 413-3000  
Fax: (703) 413 -2220  
(OSMMN 06/04)  
SPW/EDG/RR/LS/rac  
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<sup>3</sup> Seutter, p. 6, paragraph 0043.